Milking method and milking device with a qualitative characterisation of milk

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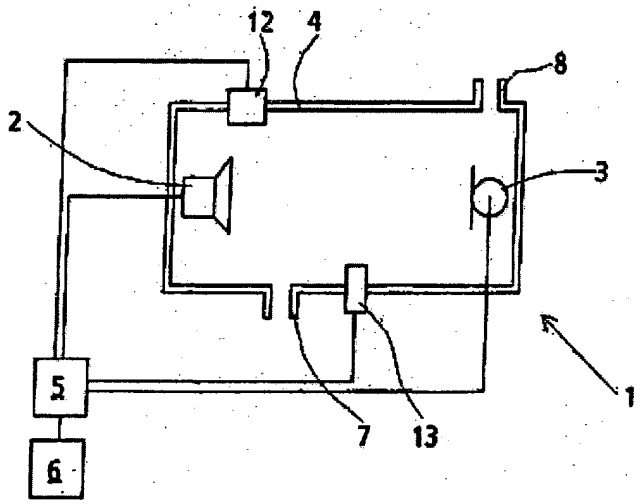
Abstract of **EP1287737**

In a dairy herd milking process one or more samples of milk are extracted from the main supply and tested for quality. The sample is exposed to a sensors which emit and receive signals. A characteristic quality value is derived from the signal received. <??>The milk quality is given as an acoustic value arising from sound absorption. Also claimed is a commensurate assembly with a calibrated dual-frequency sound emitter. The assembly has a control unit (5) which compares the acoustic signal against known values at given temperature, and the speed of sound in milk, using known frequency and/or phase speed values. The acoustic signals emitted are pre. in the frequency range 500 - 200 MHz. The assembly has a particle sensitivity in the range 0.1- 4 mm.



Figur 1

Result Page

[0001] The invention relates to a method as well as an apparatus to the milking with quality inspection of milk, whereby the apparatus exhibits an acoustic system for the quality inspection of milk.

[0002] With milking devices and - with the automatic and automated milking with half and also fully automatic milking systems muddled generally and in particular play widened functions an increasingly larger roller.

[0003] A problem with the automatic and also semiautomatic milking is the check of the quality of the milk in particular also on sense-due changed components. Sense-due changed milk is contaminated milk, which differs in its feature according to colour, smell or consistency opposite negotiable milk unwanted remarkably. Sense-due changed milk is for example contaminated by straws, excrement, flocs, blood or pus. Flocs can be contained in the milk with a Mastitiserkrankung of the animal which can be milked; such milk must become seperate.

[0004] Therefore with the manual milking the Vorgemelk is examined by the Melker first for sense-due changed components. If the Vorgemelk of the examination is sufficient, the then further milked milk is passed on into the common milk supply, while it is derived directly otherwise into a separate container or.

[0005] However if an examination of the Vorgemelks is omitted and if the milked milk is led into a collection container for several animals, it can happen that the entire milked milk cannot be used for the normal milk production, even if the milk only one animal or also only one animal is contaminated on e.g. Mastitis gets sick is.

[0006] Therefore an automatically taking place examination of the milk is with the milking a goal with automatic and in particular also with robot-supported milking systems.

[0007] From the DE 196 01 944 A1 an apparatus is well-known to the measuring of acoustic values in fluids. Such devices become inserted, over by means of acoustic methods information about acoustic properties of a fluid and/or. to receive going beyond it over the nature of the fluid as such.

[0008] From the disclosure writing DE 1,498,622 a method and an apparatus are well-known to the quantitative determination of the content of milk solids of a milk product. Such methods are used in dairies and such a thing, in order to determine the components of the milk products. The accurate fat portion and the portion of proteins in the milk are determined by the determination of acoustic properties. Such apparatuses and methods are machine complex and expensive and need much time to the result are present.

[0009] With the article ?extinction of light OF ultrasound in milks and creams? of C.A. Miles in Ultrasonics 1990, volume. 28, S. 394-400 is further a method to the estimate of the concentration at fat and grease-free components in milk admits become.

[0010] A substantial drawback with the well-known milk investigation procedures lies in the fact that the used analysers are expensive voluminös and, whereby the feedthrough of the investigation procedures is time-consuming. For the element in dairies that is not a substantial problem, since a central analyser or some few central analysers is sufficient (and/or. are sufficient).

[0011] In order to accomplish automatic control of the milk with the milking, it is however necessary that for each animal or even each teat of an animal a separate analyser is used. That leads with well-known milk analyzers to costs, which possible an economical use in automatic milking systems does not make.

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[0012] To object of the current invention, a method to the milking as well as a milking device are to the order to be placed to judge with which during a milking procedure an examination of the milk be taken place can, in order the quality of the milk.

[0013] This object becomes according to invention by the method with the features of the claim 1 and by the apparatus according to invention with the features of the claim 21 detached. Favourable training further and aspects of the invention are item of the Unteransprüche.

[0014] The method according to invention serves for the qualitative characterization of milk during a milking procedure. In addition at least an acoustic Sendesignal is radiated, which is affected by the milk. A received signal is taken up. From the taken up received signal at least one characteristic value is derived, which is suitable to characterize the quality of the milk.

[0015] The apparatus according to invention covers at least a measuring device, which exhibits a measuring chamber mechanism, an acoustic transmission mechanism and a receipt mechanism. In the measuring chamber mechanism the milk is examined. The acoustic transmission mechanism sends at least one Sendesignal. The receipt mechanism takes up at least one received signal. A evaluation device derives one characteristic value, which is suitable for characterizing the quality of the milk from that at least received signal at least.

[0016] The method according to invention and the apparatus according to invention have many advantages.

[0017] According to invention the quality of the milk can be determined by the inset of the method according to invention and/or the apparatus with the milking. It is reached that e.g. only milk into a collection container is led, which is qualitatively suitable for the subsequent treatment. The danger of the contamination of the milk in the collection container reduces by milk of insufficient quality class completely substantially.

[0018] Another advantage is that with the milking of an animal a statement can be met directly for the quality of the milk of this animal. That can e.g. are used, in order to supply with insufficient quality the appropriate animal of a more detailed visual or also veterinary examination.

[0019] A further advantage is that it is in principle made possible to meet after termination of the entire milking procedure a quality statement to the ermolkenen milk altogether.

[0020] Preferred the quality of the milk is examined regarding sense-due changed components. In addition a characteristic value is derived, which is characteristic of at least, changing sense-due the milk, component of the milk.

[0021] Preferentially it is then that with the method decision criteria can be derived over the quality, in particular the sense maturity.

[0022] At least occasionally with the milking a portion that or the entire milk is introduced into the measurement chamber. The acoustic transmitter spends an acoustic signal, which is affected by the milk existing in the measurement chamber. The receiver takes up a received signal and from this at least one characteristic value is derived, which characterizes the quality of the milk.

[0023] It is possible that with the Anmelken a part of the Vorgemelkes is only examined or however essentially the whole Vorgemelk. In addition, it is possible that only after the Anmelken one examines or both and. The measuring can be essentially accomplished over the entire milking procedure continuous, periodically or in a random sampling way.

[0024] From in such a way won values at least a relevant characteristic value of the milk is derived. To the judgment of the quality in a further training the characteristic value is compared with a reference size.

[0025] The advantage from acoustic methods is that they are less trouble-prone contrary to optical methods, since the cleaning expenditure of the acoustic system precipitates smaller and the wavelengths of the used sound typically around a multiple are larger than typical wavelengths with optical methods, which lie in the nanometer range. Due to the substantially larger acoustic wavelengths, the adjustment of the acoustic system is comparatively simple.

[0026] In a preferential further training the milk on flocs is examined, like it e.g. with a Mastitiserkrankung to arise can. Preferably a measure for a portion becomes and/or. an occurrence of particles or flocks in the size starting from approximately 0.01 mm, preferably off approx. 0.05 mm up to approximately 20 mm and particularly prefers in the area between approximately 0.1 mm and about 6 mm derived. Also the determination within the particle range 2 mm is preferential.

[0027] In a further preferential further training the milk becomes regarding excrement and/or straw and/or blood and/or. Pus examines.

[0028] Typical frequencies of the used sound lie between 10 cycles per second and about 500 MHz. Frequencies between approximately 100 kHz and 200 MHz inserted are preferred. A suitable frequency is for example 2 or also 3, 5, or 10 MHz or such a thing. It however pointed out that the use of all sonic frequencies is possible, with those concentration differences of individual components and in particular also sense-due changed components in the milk the acoustic properties to affect.

[0029] Preferably at least one sonic frequency is used, with which sense-due perceptible components of the milk differ high-contrast and particularly preferentially particularly high-contrast from those ?more normally? milk. However also still different factors play a roller, like z with the selection of the frequency or frequencies. B. the price, the size, the shelf life and the maintenance-free operation of the transmission mechanism, the receipt mechanism and the control device. Therefore it is also possible to use a sonic frequency for the measuring with which only small differences in the milk can be determined.

[0030] With the help of the transmission mechanism sound is sent, which is taken up by the receiver. In addition at least one receipt mechanism for acoustic signals is sensitive.

[0031] In addition, it is possible that an optical receipt mechanism use finds. An optical receipt mechanism can take up for example under utilization of acustooptical effects an optical received signal, which is characteristic of at least a sense-due changed component of milk.

[0032] In addition also a separate acustooptical transducer means can, like e.g. one or more Pockels cells or such a thing, inserted will, in order to convert the acoustic Sendesignal into an optical received signal. Such a optical receipt mechanism can find use instead of an acoustic receipt mechanism or also additionally in addition.

[0033] In a preferential further training the apparatus according to invention is calibrated. By a calibration of the acoustic system and/or. the sending mechanism (EN) and the receipt mechanism (EN) can e.g. (acoustic) the transfer function of the system to be seized, so that an influence of the system can be out-counted as such on the results of measurement and avoided on it.

[0034] In a further preferential further training the apparatus according to invention is calibrated at pre-determined or also selectable opportunities (RH). For example it is possible the device according to invention to the milking with each maintenance procedure or also once a year, monthly, weekly or daily or such a thing or also before everyone or each second etc. Milking procedure too (RH) calibrate.

[0035] A regular Rekalibrierung of the milking device offers many advantages. A changing acoustic transfer function of the milking device and/or. the measurement chamber due to e.g. Aging and wear can be considered by regular Rekalibrierung of the apparatus, so that errors can be reduced with the measuring or essentially avoided. That applies natural to a calibration with each milking procedure, whereby it is not necessary for success according to invention, with each milking procedure to rekalibrieren in particular. Here a consideration must be met by necessary resolution or also accuracy and necessary effort for each application.

[0036] In a preferential further training at least an acoustic absorptance value is taken up. Preferably in addition the received signal is set in purchase to the Sendesignal. In addition the relationship of the transmitted loudness to irradiated loudness can, i.e. the relationship from the receiver taken up of the Schallsignals or - spectrum to the Schallsignal emitted by the transmitter or - spectrum, to be derived. An absorptance value can absorptiven the so-called, i.e. the sound of absorbing aspects at least an acoustic property of the examined cloth represent.

[0037] Preferably at least two absorptance values are taken up, whereby e.g. with first a first sonic frequency and e.g. with second a second sonic frequency is used. Also a continuous or quasi-continuous absorption spectrum (or also several absorption spectra) can be derived. Possible also the measuring is with two, three, four, five or a multiplicity of discrete frequencies or frequency domains.

[0038] With the help of the acoustic absorptance values and/or. also - spectra can be seized the absorptiven areas in the regarded frequency window of the sound in the milk. Often it is sufficient in addition, to measure with only or two individual frequencies the attenuation of the sound in the examined cloth.

[0039] A dispersion spectrum places one to the speed of sound and to the absorptance value and/or. - spectrum supplementing or also alternative value. With dispersion of designated one all phenomena with speeds, those of their (sound) frequency, connected with the undulation of a current (sound) shaft, and/or. Wavelength depend.

[0040] From the acoustic characteristic values (e.g. Speed of sound, absorptance value and/or. Absorption spectrum and so on) (or several) a relevant characteristic value can be derived from milk. In addition the information with the acoustic properties, contained in the measured acoustic values, is set by milk with well-known composition in relationship. For example can depending upon absorptivities of the milk with the respective frequencies and/or. Frequency domains conclusions on the fat portion in the milk pulled become.

[0041] Since the acoustic properties are dependent on the temperature thus also on cloths and on milk, it is appropriate to determine the

temperature of the milk which can be measured with measuring of an acoustic characteristic value (speed of sound, acoustic absorptance value etc.).

[0042] It is also possible to stop the temperature of the milk which can be measured to a pre-determined or selectable value before a determination of the acoustic properties takes place. Favourably also the heating up and/or cooling of the milk can and/or. Milk sample before or also with the measuring its. A simultaneous heating up (cooling) during the measuring also possible, since the necessary gate time is small in relation to the time, in which a relevant change of temperature took place.

[0043] In a special aspect of the invention the speed of sound and/or at least an acoustic absorptance value are measured by milk, in order to determine the quality.

[0044] In a further aspect of the invention at least two spectra become (and/or. Rows of spectral values) measured, and it are determined characteristic values by milk from the two absorption spectra and/or the appropriate sound speeds.

[0045] It is also possible to accomplish at least a measuring at at least a second temperature whereby the second temperature differs from the first temperature. Preferably the second temperature is more largely as the first, there it typically simpler is to be heated, than cooling.

[0046] Altogether it is preferential that the measuring temperature of the milk lies in the temperature range, as milk is liquid thus between freezing point and boiling point. For many applications (depending upon planned subsequent treatment of the milk) a favourable temperature measuring range lies between approximately 5 DEG C and about 45 DEG C.

[0047] It is particularly preferential that at least one temperature level lies in the area, which the freshly milked milk has naturally, since then for this temperature level no additional heating or cooling must be made. This temperature level depends on the animal species which can be milked (all milk-supplying animals as for example cows, sheep, goats, camels, horses, donkeys, Lama, Dromedar, buffalo, moose and other mammals) and the site conditions (temperature, tube length and - material etc.).

[0048] In particular with the determination of several components in milk is it preferentially at least one characteristic value (e.g. To measure speed of sound and/or at least an acoustic absorptance value) at at least two different temperatures.

[0049] From the different values or also spectra, which differ depending upon temperature dependence of the acoustic properties of the respective individual components, information about the composition of the milk can be received.

[0050] The milk can be examined regarding its quality, as the characteristic values of the composition of the milk are compared with given reference sizes. Bordering or also can do average values and/or. Ranges around the reference sizes given or selectable its, within those the acoustic characteristic values and/or. derived characteristic values to lie must, so that the milk is sufficient for a given or selectable quality standard.

[0051] It is preferential that at least two quality classes are assigned. Indeed a quality class, which marks qualitatively ?good? milk and a further, which marks ?bad? or less suitable milk. Less suitable milk is for example milk, which exhibits sense-due changed milk, as the milk exhibits for example Mastitisflocken.

[0052] With assignment of only two quality classes it is preferential that the ?good? milk of the subsequent treatment is supplied, while the less suitable milk separately collected and/or. one derives. Subsequently, the less suitable milk can be examined again separately, in order to determine the causes. This milk can be rejected also directly, or be supplied also another processing process.

[0053] If legal settings cannot be kept any longer, the milk must become otherwise used or entsorgt.

[0054] It is also preferential that the derived characteristic value represents more than two quality classes. For example a numeric characteristic value is possible, which is determined as whole or comma number, whereby larger (smaller) values describe a higher (lower) quality. During a such finer quality tuning ?good? milk can be supplied to the normal milk processing process.

[0055] It can be intended by quality classes also a division into a row, like e.g. ?well?, ?satisfying?, ?sufficiently? and ?insufficiently?.

[0056] Then can e.g. Milk ?more satisfying? quality class still for normal subsequent treatment intended its, during e.g. Milk is transmitted ?more sufficiently? quality class another production process, which does not place so high quality requirements. Starting from a certain reduction in quality (e.g. ?unsatisfactorily? or ?insufficiently?) the milk can be rejected.

[0057] An advantage of an acoustic method is that it works contactlessly. A further advantage is the possibility essentially of meeting qualitative statements over the examined milk in real time. In training further also quantitative statements can be derived over the examined milk in real time.

[0058] Real time means here that the milk of an individual teat of a cow or the milk of a cow or a group is examined by cows within a milking procedure at least with beginnings of the milking.

[0059] In a preferential further training the examination continuous is accomplished or also quasily-continuous or also periodically. A time-dissolved measuring during the Anmelkens or also a portion of the milking procedure or essentially the entire milking offers the advantage that the milk characterizes directly qualitatively or also quantitatively and/or. one examines. A further advantage is in the fact that the milk is examined, without the milking procedure becomes essentially impaired or delayed.

[0060] In an embodiment of the method according to invention in each case the speed of sound and/or an acoustic absorptance value become and/or. acoustic absorption spectra at at least a temperature determines. Preferably at two different temperatures one measures.

[0061] Since the acoustic properties of the individual components are different at different temperatures in milk, hereby the resolving power can be increased. Preferably the different temperatures are more adjustable or given.

[0062] It can or also after or during the measuring at a first temperature warmth be exhausted, so that a second temperature adjusts itself, which depends on different factors, like e.g. the ambient temperature and the milk river quantity. The arising second measuring temperature can be determined by a further measurement of temperature and/or. a characteristic value for it to be derived. By comparison with well-known values, e.g. , can then the measured values and characteristic values are put down in a table be determined (also e.g. over a inter or an extrapolation procedure).

[0063] That e.g. is. by the fact possible that two measurement chambers are one behind the other arranged. After leaving the first measurement chamber the milk passed on to the second measuring chamber can become heated around a given measure (or cooled down), by e.g. the wire (e.g. electrical is heated). Possible is it also that instead of its or additionally the second measurement chamber is heated or cooled, so that the milk in the second measurement chamber exhibits another temperature than in first. For cooling can e.g. an equipment with one or more Peltierelement (EN) to be used.

[0064] The measurement chambers can be arranged also parallel to each other, whereby one then e.g. (or cooled) and the other one does not become heated. It can also be that both feed lines become heated (cooled), whereby a feed line or also a measurement chamber more

strongly heated (cooled) becomes than the other one. The measuring temperatures can be impressed by such or similar measures, in order to measure at given measuring temperatures.

[0065] It is particularly favourable to divide the milk stream into at least two component currents which are brought on different temperatures and in each case regarding their acoustic properties, in particular the absorptivity analyzed become.

[0066] By the choice of suitable measuring points and also and/or. Derivatives also with parallel array and even with a timed change of the composition of the milk in substantial the same milk is examined. Thus inaccuracies are avoided with the measuring due to timed fluctuations in the composition of the milk, which manifest themselves along the Milchleitung.

[0067] In a preferential further training of the invention uniquely with production or regularly to pre-determined or selectable distances or such reference sizes for the collection of the transfer function of the acoustic system are taken up. By reference sizes the influence of the transfer function of the acoustic sending mechanism or the acoustic system on the results of measurement can be out-counted. Suitably as reference size is for example a reference spectrum.

[0068] Meaningfully a measuring of mehrer spectra can and/or. Spectral values its, there certain contents materials in milk well into spectrum however an only bad one in the other spectrum recognizable to be can. Here an additional spectrum can be measured and/or be taken place the measuring of the speed of sound with different frequencies and/or the determination of a dispersion spectrum and/or the measuring of the phase velocity from sound in milk and/or the measuring of the frequency-dissolved group velocity from sound in milk.

[0069] A measuring is favourable with at least two frequencies, there some contents materials of the milk with a frequency well, however only bad one with another frequency is recognizable.

[0070] Something similar applies to the measuring at two temperatures. However the use is to be always compared with that effort. During a sense maturity regulation of the milk also the measuring can be sufficient at a temperature and with a frequency.

[0071] With the device according to invention are preferably the transmitter, the measurement chamber and the receiver in an acoustic beam path arranged, and the transmitter and the receiver are preferably connected with a tax A MECHANISm.

[0072] With the help of the acoustic system the speed of sound and an acoustic absorption spectrum will become taken up and with the help of a comparator the characteristic values, which are won from the acoustic absorption spectrum, compared with given reference sizes. It is determined by the comparison whether the examined milk is sufficient for the given milk standard.

[0073] In a favourable embodiment of the apparatus according to invention are at least one heating element for keeping at a moderate temperature the milk and at least with the measurement chamber connected to thermometer mechanism. With the heating element and the thermometer mechanism will the desired temperature adjusted and can be also readjusted.

[0074] With a further favourable aspect of the invention at least two Messkammem are connected to thermometer mechanisms (as for example a thermocouple or a temperature-dependent resistance or so on) with in each case a heating element and by separate wires with a main line in each case.

[0075] With measuring of the acoustic properties at at least two temperatures additional information about the milk is seized.

[0076] Preferably the milking procedure in dependence of characteristic, acoustic values becomes controlled. For example milk stream are kept away and exhausted from animals with sense-due changed milk from the milk main line, the keeper of an animal over the condition and/or. the quality of the milk of an individual animal informs, or the food and/or. the Medikamentierung of an individual animal according to the characteristic, acoustic values the milk adapted.

[0077] In a preferential further training the composition of the milk becomes, in particular regarding its aqueous components in relation to the fat content and/or. for the solids such as salts, solved in the milk, at least partly intends. In addition additionally also methods can become inserted, e.g. the conductance use or it can over density measurements or optical methods, with which coloured changes of the milk can be determined, which portions are determined. Also screens, in order to determine the content of flocs in the milk, can be used.

[0078] After a further favourable embodiment of the device it is suggested that control means are intended at least to the control of the measuring device. The control means can serve also for the control the apparatus and/or for releasing or for terminating method steps during a milking procedure.

[0079] Further advantages and preferential embodiments are described on the basis the following figures. These clarify exemplary some components of the invention exemplarily. In it show:

Fig. 1 A milking device according to invention with quality inspection,
Fig. 2 an arrangement according to invention of two measurement chambers with two separated wires.
Fig. 3 Results of measurement of the speed of sound and the absorbance of normal milk over the temperature, and
Fig. 4 Results of measurement of the speed of sound and the absorbance of sense-due changed milk over the temperature.

[0080] In the embodiment an acoustic system 1 is used for the judgment of the quality by milk with the milking, as it is represented in figure 1. To the milking the teat cups (not represented) of a to that extent conventional milking device are attached to the teats of a cow. With the Anmelken the Milchleitung (not represented) with milk fills.

[0081] In Fig. 1 represented acoustic system 1 exhibits a measurement chamber 4, a transmitter 2 and a receiver 3. Milk is exhausted over an inlet 7 4 and over an outlet 8 introduced into the measuring chamber. Thereby a continuous characterization is made possible by milk in the flow procedure.

[0082] The measurement chamber 4 filled with milk is brought to 13 with the help of a heating element 12 and a thermometer on a desired temperature and/or. kept.

[0083] The transmitter 2, the receiver 3, the heating element 12 and the thermometer 13 are connected with a control unit 5. The transmitter 2 emits sound with defined intensity with given frequency. The receiver 3 takes up this sound, which runs by the milk existing in the measurement chamber 4. By quotient formation of the taken up signal by the emitted signal in dependence of the emitted sonic frequency an acoustic absorption spectrum is determined.

[0084] From the acoustic absorption spectrum characteristic values are determined by milk, like e.g. their composition or also values, which describes the sense maturity of the milk.

[0085] These values are passed on to a comparator 6, which compares these with given reference values and so that regarding their quality classifies the measured milk.

[0086] Fig. 2 shows two acoustic systems 1, which are equipped with a heating element 12 and a thermometer 13 in each case, in order to

be able to hold the systems in each case on a given or selectable temperature.

- [0087] The milk flowing in a main line 9 is divided into two component currents, those in two separated wires 10, 11 by two measurement chambers differently kept at a moderate temperature flows in each case with in each case an acoustic system. In the measurement chambers 4 the component currents are examined.

[0088] With the help of this arrangement it is possible to infer from the main milk stream at the same location two partial milk stream and examine these, whereby an incorrect comparison is avoided for example by milk at the beginning of a Gemelkes with milk of the end of the Gemelks.

[0089] In figure 3 measured values at normal milk of good quality class, which does not show any sense-due changes, are laid on. Over the temperature 30 of the milk (left ordinate) the relative transmission 31 of the sample is laid on. On the right side the ordinate represents the relative speed of sound 32 of the sample.

[0090] In the temperature range of relatively small temperatures 34 with approximately 15 DEG C the absorbance is stronger than in a middle temperature range with approximately 25 to 30 DEG C, in which the maximum 35 of the transmission lies. To higher temperatures 36 the transmission drops again and is with approximately 40 DEG C again at values as about 15 DEG C. In the concrete measuring case the transmission in the maximum 35 about 66% and at the boundary regions of the measuring about 64% amounted to.

[0091] The process of the relative speed of sound 37 is also in Fig. 3 over the temperature laid on. From low temperatures 38 the speed of sound rises to the higher temperatures 39, whereby the upward gradient with increasing temperature becomes smaller.

[0092] For the 4 measured values represented in figures 3 and the measuring with a frequency was accomplished by 2 MHz. But also substantially higher and low frequencies are possible for the measuring.

[0093] In Fig. 4 is laid on the processes of the relative speed of sound 40 and the relative transmission 43 over the temperature with sense-due changed milk. Here the flake size of the milk essentially was because of Mastitis of gotten sick animals in the Grössenbereich up to approximately 2 mm.

[0094] In the lower and middle temperature range between approximately 15 DEG C to approximately scarcely 30 DEG C the absorption with the temperature approach does not change, while starting from a temperature of approximately 28 DEG C to higher temperatures the absorption rises and thus over the left flank 45 the transmission with increasing temperature up to the minimum 47 falls.

[0095] In the minimum 47, which lies between 35 DEG C and 38 DEG C, the transmission amounts to in the example about 62% here, while the transmission in the low temperature range amounts to 44 about 67%. To higher temperatures the transmission rises on the right flank 46.

[0096] Thus a completely substantial difference of the absorption behavior of flockiger milk is in particular visible compared with normal milk at usual milking temperatures. In addition, at low and high temperatures clear differences are to be recognized.

[0097] With normal milk the transmission amounts to however with approximately 36 DEG C between 65 and 66%, while the transmission of flockiger milk amounts to 62%. Hence it follows that also the measuring of the transmission is sufficient at only one temperature, i.e. for example 36 DEG C, in order to determine the quality of the milk.

[0098] Possible e.g. is. the segregation of milk, their transmission under a pre-determined transmission value (e.g. 64% or 65%) at a pre-determined temperature (e.g. 36 DEG C) falls.

[0099] Possible also the verification is at a second temperature. So a second measuring can e.g. at a low temperature of 15 DEG C to be accomplished. The flockige milk has thereby a higher transmission of approximately 67%, while normal milk exhibits only about 64% transmission.

[0100] Also the measuring of the speed of sound is suitable for the quality inspection. The process 40 of the speed of sound over the temperature 30 with sense-due milk is steeper. The speed of sound of sense-due milk is smaller in the smaller temperature range 41 with approximately 15 DEG C than the appropriate speed of sound of normal milk. Turned around the speed of sound of sense-due changed milk in the high temperature range 42 more largely than the speed of sound of normal milk in the same temperature range 39. Also the determination of the speed of sound permits thus the reliable detection to sense-due changed milk.

[0101] This applies only quite with measuring of two different temperatures. Both the speed of sound and the transmission exhibit clear temperature dependences, which can be used for the qualitative and also for the quantified judgment of milk.

[0102] Sense-due changed milk and in particular milk of one at Mastitis got sick to cow form flocs, so that the milk is present as a Zwei-Stoffgemisch. Because certain components in the flocs concentrate, changes in the aqueous phase the composition. Thus the acoustic properties of both phases are affected.

[0103] An advantage of the measuring of an acoustic property opposite the measuring of an optical property is further that the milk can differ in its colour depending upon season, fodder or also animal species. With optical measurement methods such coloured differences can cause measuring differences, which can make a judgment more difficult of the results of measurement and worsen the measuring accuracy.

[0104] In further embodiments the measured values know and acoustically determined parameters and characteristic values also to the analysis of the milk contents materials be used. For example the fat portion and the portion of proteins can be determined. Further further components of the milk can be determined, how also in the state of the art milk analysis devices admitted it are possible. Then a complex analysis in the dairy can be omitted.

[0105] The acoustic performance used for the measurement is preferably so small that the milk is essentially not damaged. For the acoustic system and/or. the transmitter can a Piezo stack or such a thing be used, which preferably works with small voltages, so that also with possible malfunctionings and damage the animals which can be milked are not damaged. Preferably the voltage is smaller 50 V).

[0106] For the outgassing of the air bubbles a Beruhigungstrecke can to be to the measurement chamber intended or it be able further constructional measures to be intended, in order to remove air bubbles at least partially from the milk, which the results of measurement could disturb. Also homogenization of the milk in the measuring volume or the ermolkenen milk can supply better results of measurement.

[0107] As the further characteristic value for the quality regulation of the milk also a measure for acoustic impedance can be derived.

Reference symbol list

1 acoustic system
2 Transmitter
3 Receiver

4 Measurement chamber
5 Control unit
6 Comparator
7 Intake
8 Outlet
9 Main line
10, 11 Wire
12 Heating element
13 Thermometer
30 Temperature
31 relative transmission
32 relative speed of sound
33 Absorption process
34 low temperature range
35 Maximum
36 high temperature range
37 Speed of sound process
38 low temperature range
39 high temperature range
40 Speed of sound process
41 low temperature range
42 high temperature range
43 Absorption process
44 low temperature range
45 link flank
46 right flank
47 Minimum

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Result Page

1. Milking procedure with qualitative characterization of milk
with which at least occasionally with the milking at least a part of the milk is examined, in order to determine the quality of the milk,
as at least one Sendesignal is radiated,
at least one received signal is taken up, and
from that at least one received signal at least one characteristic value one derives, which characterizes the quality of the milk.
2. Milking procedure according to claim 1,
characterised in that at least this at least characteristic value the quality of the milk regarding at least a sense-due changed component characterizes.
3. Milking procedures according to claim 1 or 2,
characterised in that derived from the received signal at least one characteristic value is characterized, the one acoustic property of the milk.
4. Milking procedure after at least one of the preceding claims, characterised in that is measured at least an acoustic absorption characteristic value of the milk.
5. Milking procedure after at least one of the preceding claims, characterised in that the Sendesignal at least two frequencies covers.
6. Milking procedure after at least one of the preceding claims, characterised in that the Sendesignal at least one spectral region covers.
8. Milking procedure is determined according to at least one of the preceding claims, characterised in that at least one calibration characteristic value.
9. Milking procedure after at least one of the preceding claims, characterised in that is derived at least one characteristic value, which is a characteristic measure for the speed of sound.
10. Milking procedure is determined according to at least one of the preceding claims, characterised in that at least one absorption spectrum.
11. Milking procedure after at least one of the preceding claims, characterised in that is derived at least one temperature characteristic value, which is characteristic of the temperature of the milk which can be measured.
12. Milking procedure after at least one of the preceding claims, characterised in that is derived at least one characteristic value at at least two temperatures.
13. Milking procedure after at least one of the preceding claims, characterised in that at least a temperature is more adjustable.
14. Milking procedure after at least one of the preceding claims, characterised in that is compared at least one characteristic value with at least one reference characteristic value.
15. Milking procedure after at least one of the preceding claims, characterised in that the speed of sound in dependence the group velocity frequency-dissolved by the frequency and/or the phase velocity of sound in milk in dependence of the sonic frequency and/or by sound in milk in dependence by the sonic frequency to be measured.
16. Milking procedure after at least one of the preceding claims, characterised in that the milk into at least two parts, which can be examined, is divided, and at different temperatures regarding their acoustic properties analyzed become in each case.
17. Milking procedure according to claim 16, characterized thus,
that at least two different parts of the milk essentially simultaneous which can be examined to be examined.
18. Milking procedure after at least one of the preceding claims, characterised in that at least a part of the milk essentially timed which can be examined successively at first and a second temperature to be examined.
19. Milking procedure after at least one of the preceding claims, characterised in that reference sizes for the collection of an acoustic transfer function to be taken up.
20. Milking procedure after at least one of the preceding claims, characterised in that the milking procedure in dependence of that at least one characteristic value controlled becomes.
21. Apparatus to the milking with qualitative characterization of milk also
at least an evaluation device and at least a measuring device, which are derivable at least measurement chamber (4), at least acoustic transmission mechanism (2) and at least one receipt mechanism (3) enclosure whereby into those at least a measurement chamber (4) at least a part of the ermolkenen milk;
with that at least acoustic transmission mechanism (2) at least an acoustic Sendesignal is radiatable;
and with that at least receipt mechanism (3) at least one received signal is receptible, which is affected by at least an acoustic property of the milk;
and whereby those is suitable at least an evaluation device (6) for deriving from that at least received signal a characteristic value which characterizes the quality of the milk.
22. Apparatus according to claim 21, characterized thus,
that the evaluation device (6) is suitable for deriving from that at least one received signal at least one characteristic value which characterizes the quality of the milk regarding at least a sense-due changed component.
23. Apparatus after at least one of the claims 21 and 22,
characterised in that at least one temperature measuring instrument (13) is intended, with which a measuring temperature is receptible.
24. Apparatus after at least one of the claims 21 to 23,
characterised in that at least one heating mechanism (12) and/or cooling equipment at this measuring device is intended.
25. Apparatus after at least one of the claims 21 to 24,
characterised in that the frequency of the radiated Sendesignals in the area between 500 kHz and 200 MHz lies.
26. Apparatus after at least one of the claims 21 to 25,
characterised in that at least two measurement chambers (4) are intended.
27. Apparatus after at least one of the claims 21 to 26,

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characterised in that a characteristic value for a particle number in the Grössenbereich 0.1 mm up to 4 mm is derivable.

28. Device after one of the claims 21 to 27, characterised in that control means at least to the control of the measuring device is intended.